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Optimal Positioning in Thailand's Spot and Future Market

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Abstract

This paper examines the intraday price lead-lag relationship between TFEX Index future, single stock future and their underlying cash indices using ten-minute data. Candidate series being traded within TFEX are chosen based on liquidity criteria. Engle-Granger Cointegration is applied to explain bivariate long-run relationship and the Threshold Vector Error Correction Model is practiced to estimate the short-run adjustment parameters. A portfolio is afterward constructed on the basis of pair trading strategy to evaluate the performance of the model and predictability power. Also an alternation of weight ratios putting on the investment of future and cash is done to reduce the risk of wrong positioning. The result suggests that single stock future price movements lead its cash price while the causal relationship between SET50 future and its Index is bi-directional with eventual lead of future price. Arbitrage opportunities present in SET50 future derivative market and have strong impact on the dynamics. Besides, short run trading strategy fails in single stock future market due to low variability in the stock cash price and short-selling restriction. Investment ratio of 70:30 in future and cash perform best in SET50 market and the 100:0 ratios minimize the loss in single stock market.

Keywords: Threshold Cointegration; Asymmetric Price Discovery; Pair Trading; Future and Spot

1. Introduction

In November 2006 Thailand Futures Exchange (TFEX) was established providing traders a new alternative of investment namely single stock future which is considered as a derivative. Since then, trading in this contract has grown steadily and dramatically. The benefits of trading futures are derived from economic incentives on traditional financial instrument namely stocks and bonds. First, Future contracts provide means of risk allocation. Second, futures can summarize useful price information within the economy. And third, derivatives can reduce the transaction costs within the market. According to the reasons, futures contracts widely become a hedging tool which can eliminate certain risks of holding stocks and increase the welfare of portfolio's holders when their portfolios more closely meet their objectives.

Future derivatives seem to benefit investors only if their prices are tightly linked to the prices of their underlying assets. If the price of a future contract moves independently, this financial instrument will not be an effective risk-management tool. However the independent moves between the two prices can be

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cited to occur solely in short-run according to the well-known cost-of-carry model of future and spot. The theory states the long-run relationship of the two prices or, in econometrics, that the two prices are cointegrated. The presence of short-run independent moves, mostly in practice, draws out many studies to explain the relationship using different means and techniques. In several markets, future prices are found to lead the cash prices—Stoll and Whaley (1990), Chan (1992), and Tse (1995). The discovered can be in a contrast. Shyy, Vijayraghavan and Scott-Quin (1996) reported the opposite direction. And also another view of bi-directional causal relationship is reported by Liu and Zhang (2006), Mukherjee and Mishra (2005) and Abhyankar (1998).

The discovery of lead-lag relationship within markets is a strong empirical evidence to market inefficiency. Any mispricing becomes an arbitrage opportunity. Mispricing often reflects an arrival of a piece of news to a group of investors who impound new information into prices of the market they are in and cause a shift to the price's behavior. So, it would take a period of time for the rests of investors of both markets to take into account the new information and adjust their holdings. As a result, market efficiency grows under a period of time and opportunities of arbitrage profit can be taken.

The nature of lead-lag relationship seems predictable but in practice it is partially correct. As new information arrives, the investors of second-hand news have to bear the cost of approaching to be informed and also the cost of afterward portfolio reallocation including transaction cost, interest rate risk, dividend risk and buying-selling restrictions (Kadir et al., 2011). Thus, the arbitrage activities are not taking immediately as the mispricing occurs. Now the investors' decision become whether the profits of reallocating their portfolio after the information exceed the costs they are facing. These actions lead the adjustment to exhibit different behaviors at each time and the length of time it takes varies in each situation. Recent financial literatures, namely Hansen and Seo (2002) suggest that the dynamic adjustment between two markets within the model may be non-linear due to the presence of transaction cost preventing the holders from adjusting continuously. Consequently, some financial literatures suggest the construction of different regimes of investors' decision-- Theissen (2011), Tse and Chan (2010), Marten and Kofman (1998) and Sunthorn Thongthip (2010). The regimes under no adjustment are represented by a band called no-arbitrage band. This no arbitrage band can be a beneficial tool in investment decision making. Investors are to invest only if the mispricing occur and exceed the no-arbitrage band.

The construction of no-arbitrage band was based on the econometric concept of threshold cointegration introduced by Balke and Fomby (1997). They suggested that the adjustment does not need to occur instantaneously but only once the deviations exceed some critical threshold, allowing the presence of inaction or no convergence band. The extension model developed to capture this market behaviour is the Threshold Vector Correction Model (TVECM). In this model, the error correction term is spitted into regimes which respond varyingly to each deviation based on different threshold critical values. As the asset holders are facing constraints in trading assets in both markets (spots and futures) forcing them to take discrete actions, the dynamic relationship between prices should be characterized as a nonlinear. Thus the nonlinear TVECM is to be employed to explain the asymmetric bidirectional causality and also price transmissions between these two markets either in short-run and long-run. Similar examination of prices is applied to create a trading strategy called "Pair Trading." When two prices which are found historically to be cointegrated, exhibit a considerably large gap between them, investors are incentivized to take a short-position of the higher price and take a long-position of the lower price with a belief that both prices will soon converge to their mean and enjoy a profit. Consistently, in the case where future exceeds spot price and a significant mispricing presents, the TECM model of Lee and Chang (2007) and Sunthorn Thongthip (2010) suggested a short in future and a long in cash stock or index in order to receive the arbitrage profit as both prices establish tendency to converge. When the convergence takes place, the arbitrage profit (investors gain) is the combination short profit from future and margin gain from the rise of cash or index taken out all transaction costs.

However, the convergence is not always occupied by both prices. Sole price adjustment might occur if only one price is in disequilibrium. Thus, taking positions in both markets could double the cost while the gain from trading is only one-sided and consequently the cost could overwhelm the profit. In a possible case, only one price was driven away from the long-run equilibrium which refers theoretically to the true common stochastic trend line while another price is moving along with the true trend. So the adjustment process only occurs with the price that meanders from the real trend. This paper suggests the alternation of investment to each price to solve this problem as an alternative to testing for time-varying leader. If the one-sided adjustment occurs, the investing ration of 100%:0% would perform best. Several ratios are to be evaluated as an indicator of eventual leader.

2. Data and Methodology

Two candidate series are chosen based on liquidity criteria at ten-minute frequency data from 12th September 2011 to14th November 2011. The first future and cash pair matches SET50 Index future maturity in December 2011 to SET50 Index and the second pair selected is KTB single stock future and KTB cash price. Data is provided by E-finance Thailand Smart Portal software. Series are calculated at every open ten minute period starting from 9:50 to 16:50 each day. Thus 1320 observations are constructed within 43 trading days. In case of no trading at a particular period, the last available price has been used. The price short run dynamics are examined using threshold vector error correction model (TVECM) based on linear cost-of-carry model with constant asset yields hypothesis and also in logarithmic form follows Martens, Kofman, and Vorst (1998). The model is constructed as

$$\begin{bmatrix}\Delta F_t\\ \Delta S_t\end{bmatrix} = \begin{bmatrix}C^F\\ C^S\end{bmatrix} + \begin{bmatrix}\propto_F^i\\ \propto_S^i\end{bmatrix} ECT_{i,t-1} + [\boldsymbol{\beta}]\begin{bmatrix}Lag\Delta F_t\\ Lag\Delta S_t\end{bmatrix} + \begin{matrix}\varepsilon_t^F\\ \varepsilon_t^S\end{matrix}$$

where F_t and S_t represent future price and its underlying asset cash price either in linear form or logarithmic form and $ECT_{i,t-1}$ represent the error correction term of the model. Speed of adjustment parameters shown as α^i are estimated under both one (i=2) and two (i=3) threshold critical values since the price of SET50 Index is strictly higher than its future and the cash price of KTB is strictly lower throughout the trading period.

A portfolio is constructed in THB currency and the costs of trading are calculated under the rules of Stock Exchange of Thailand imposed on proprietary desks. SET50 Index is assumed to be a tradable asset without bid-ask spread. Higher price will be short-sell and the lower price will be simultaneously long-buy when both prices diverge by a certain magnitude determined by the threshold critical value(s) estimated from TVECM. More precisely, the position is open as the regime shift, and the position is close when the regime re-shifts. In the case that prices do not revert before the end of trading period, returns are calculated in the last day of trading period. The ratio of investment in future and cash index is also altered with 10% variation starting from 50% in future derivative and 50% in cash asset to 100%:0% and on the other side 0%:100%.

3. Results

Table 1. summarizes the estimation of TVECM model using 10-minute data series of TFEX's SET50 future and KTB single stock future and their cash indices. The relatively dominant estimated models of both SET50 and KTB use logarithmic form series. Results of each pair are estimated under one threshold value and two threshold values and the coefficients. Returns are calculated with different investment ratio and the best perform ratio of each pair is reported. From the results, arbitrage opportunities present in SET50 index market while mispricing in KTB pair series cannot provide enough arbitrage incentives

when transaction costs are taken into net return computation. The best perform investment ratio of KTB pair reported only minimizes the loss

Table 1. Results of TVECM and Portfolio Performance

	SET50	KTB
	One threshold (2 regimes)	
Cointegrating Vector	(1, - 1.00185)	(1, -1.000183)
Number of Lags	3	3
Threshold Value	0.0058504	0.01157664
Coefficient ECT F (upper regime)	-0.0511	-0.0856
Coefficient ECT S (upper regime)	-0.0215	0.5119
Coefficient ECT F (lower regime)	0.0075	-0.0438
Coefficient ECT S (lower regime)	0.0331	0.0324
% of Obs in upper, lower regimes	21.2%, 78.8%	8%, 92%
	Two threshold (3 regimes)	
Cointegrating Vector	(1, - 1.00185)	(1, -1.000183)
Number of Lags	3	3
Threshold Values	-0.01011026, 0.0058504	0.006886051, 0.01157664
Coefficient ECT F (upper regime)	-0.0511	-0.0856
Coefficient ECT S (upper regime)	-0.0215	0.5119
Coefficient ECT F (middle regime)	0.0105	0.4748
Coefficient ECT S (middle regime)	0.0366	0.7199
Coefficient ECT F (lower regime)	0.3878	-0.0720
Coefficient ECT S(lower regime)	0.5809	0.0141
% of each regime	21.4%, 71.9%, 6.9%	8%, 8.9%, 83.1%
Lead-lag relationship	Bi-directional	F leads S
Best Perform Ratio F:S	70:30	0:100
Number of Observation	1321	

4. Conclusion

In this paper, three objectives are met. First, the long-run relationship between future and cash index market of TFEX are examined using one representative of index future namely SET50 index future with maturity on December 2011 and one representative of single stock future which is KTB future of the December maturity date. Price series are modelled in corresponding to the cost-of-carry model using ten-minute data frequency and, consequently, the lead-lag interaction is identified. Second, the short-run dynamic of the series are investigated to reveal the non-linear adjustment of the lead-lag structure. The use of threshold variables in TVEM is the approach. Arbitrage opportunities are observed under different market conditions and, as a result, guarantee market inefficiency. Third a portfolio is constructed to evaluate performance of the models and arbitrage incentives within the market. Simultaneously an alternation of investment ratio is suggested to reduce the risk of wrong positioning as eventual leader-change occurs.

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